CALIPSO SCIENCE DATA READERS
Release 4.70v1

Introduction

The Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observation (CALIPSO) satellite will provide new insight into the role that clouds and atmospheric aerosols play in regulating Earth's weather, climate and air quality. In order to do this, a wide variety of scientific data products will be available to the science community. These products will be derived from the data acquired from three on-board instruments; the Cloud-Aerosol Lidar with Orthogonal Polarization (CALIOP), the Wide Field Camera (WFC) and the Imaging Infrared Radiometer (IIR). These data products are described in the CALIPSO Data Products Catalog (DPC) currently available on the CALIPSO public web site at URL: https://www-calipso.larc.nasa.gov/resources/project_documentation.php. The Langley Research Center (LaRC) Atmospheric Science Data Center (ASDC) processes, archives, and disseminates the CALIPSO data products. The web site address for the ASDC is: https://eosweb.larc.nasa.gov/. These data products are output using the Hierarchical Data Format (HDF) designed by the National Center for Supercomputing Applications (NCSA). This work is now performed by The HDF Group (THG), at http://www.hdfgroup.org.

HDF 4 Readers

A set of basic CALIPSO data product readers has been developed to aid users in their ability to read the HDF formatted files. This set of readers is written using the Interactive Data Language (IDL) available through Harris Geospatial Solutions at URL: http://www.harrisgeospatial.com and go hand in hand with either the CALIPSO Data Products Catalog (DPC) Release 4.70. A list of the major data products, their associated readers, commons, check programs, and the corresponding DPC Table numbers are contained in the tables below.

Due to the nature of the HDF formatting and the need to assign each parameter to the appropriately named variable, there must be an exact match between variable names stored in the file and the command parameter used to retrieve that variable. These readers are written to provide users with the greatest flexibility to select only those parameters that are necessary for their applications. They were not written for efficiency as much as simplicity. There is a one-line call for each parameter, that can be commented out by placing a ';' at the beginning of the line. Already commented out in each program, but left available for the users, are print statements that will provide more detailed information about each parameter contained in the HDF file. Each reader takes as input two quoted string parameters, PATH and FILE NAME. The PATH name contains the directory path to the folder that contains the data, and the FILE NAME contains the full name of the file to be read.

The commons associated with each data product reader contain abbreviated names for each parameter. If the user chooses not to read every data product, these variables will not be filled, but will not present any problems if left in the common. Of course, the user may change these names to match the desired names for their application, but care should be taken to ensure that names are changed in the IDL code as well as the associated common. In some cases, single dimension arrays are read as two dimensional with the initial dimension being set to 1. This does not affect the data in any way but may need to be considered later when working with the arrays. In order to correct this issue, a simple call to the IDL REFORM function will adjust the array to a single dimension. For example, ArrayA is created with dimensions of (1,50). Issuing the command ArrayA = REFORM(ArrayA, /OVERWRITE) returns ArrayA with a single dimension of (50), and the actual data remains unchanged.

Simple check programs are also provided for each of the readers. These check programs are called at the end of each reader program, and are a double check to ensure that all variables are filled. The calls to the check programs can be commented out once the user is certain that all parameters of interest are read correctly. The check programs issue a 'HELP, Variable' for each of the common variables. The HELP command provides common, format, dimension and static value information for all variables. The output from the HELP command is sent to STDOUT, unless otherwise redirected. For a more detailed description of data formats, units, and ranges, please refer to the CALIPSO DPC.

Major Data Products, Associated Readers, Commons, Check Programs, Corresponding DPC Table Numbers

DATA PRODUCT	**READER NAME (.pro)**	**COMMON NAME (.pro)**	**CHECKIT NAME (.pro)**	**DPC *Version 4.70* TABLE NUMBERS**
Lidar Level 1 v4.10	read_hdf_l1_v410	L1_v410_v410_COMMON	Checkit_L1_v410	12, 13, 14, 15
Lidar Level 2 1/3km Merged Column and Layer v4.20	read_hdf_l2_ml33_v420	L2_ML33_v420_COMMON	Checkit_L2_ML33_v420	49, 53, 51, 54
Lidar Level 2 1km Cloud Column and Layer v4.20	read_hdf_l2_cl01_v420	L2_CL01_v420_COMMON	Checkit_L2_CL01_v420	49, 55, 51, 56
Lidar Level 2 5km Cloud Column and Layer v4.20	read_hdf_l2_cl05_v420	L2_CL05_v420_COMMON	Checkit_L2_CL05_v420	49, 57, 58, 50, 51, 52
Lidar Level 2 5km Aerosol Column and Layer v4.20	read_hdf_l2_al05_v420	L2_AL05_v420_COMMON	Checkit_L2_AL05_v420	49, 50, 51, 52, 59, 60
Lidar Level 2 5km Merged Column and Layer v4.20	read_hdf_l2_ml05_v420	L2_ML05_v420_COMMON	Checkit_L2_ML05_v420	49, 61, 62, 50, 51, 52
Lidar Level 2 Aerosol Profile v4.20	read_hdf_l2_aerprf_v420	L2_AERPRF_v420_COMMON	Checkit_L2_AERPRF_v420	51, 67, 68
Lidar Level 2 Cloud Profile v4.20	read_hdf_l2_cldprf_v420	L2_CLDPRF_v420_COMMON	Checkit_L2_CLDPRF_v420	73, 51, 74
Lidar Level 2 Vertical Feature Mask v4.20	read_hdf_l2_vfm_v420	L2_VFM_v420_COMMON	Checkit_L2_VFM_v420	81, 82, 80
Lidar Level 3 Ice Cloud v1.00	read_hdf_l3_icecloud_v100	L3_ICECLOUD_v100_COMMON	Checkit_L3_ICECLOUD_v100	114 - 120
Lidar Level 3 Stratospheric Aerosol Profile v1.00	read_hdf_l3_stratapro_v100	L3_STRATAPRO_v100_COMMON	Checkit_L3_STRATAPRO_v100	122 - 128
Lidar Level 3 Cloud Occurrence v1.00	read_hdf_l3_cloudoccrrence_v100	L3_CLOUDOCCURRENCE_v100_COMMON	Checkit_L3_CLOUDOCCURRENCE_v100	130 - 134
IIR Level 1 v2.00	read_hdf_iir_l1_v200	IIR_L1_v200_COMMON	Checkit_IIR_L1_v200	21, 22, 23
Lidar Level 1 v3.x	read_hdf_l1_v3x	L1_v3x_COMMON	Checkit_L1_v3x	7, 8, 9, 10
Expedited Lidar Level 1.5 v3.x	read_hdf_l15_v3x	L15_v3x_COMMON	Checkit_L15_v3x	139, 140, 141
Lidar Level 2 1/3km Cloud Layer v3.x	read_hdf_l2_cl33_v3x	L2_CL33_v3x_COMMON	Checkit_L2_CL33_v3x	35, 36, 37
Lidar Level 2 1km Cloud Layer v3.x	read_hdf_l2_cl01_v3x	L2_CL01_v3x_COMMON	Checkit_L2_CL01_v3x	35, 38, 39
Lidar Level 2 5km Cloud Layer v3.x	read_hdf_l2_cl05_v3x	L2_CL05_v3x_COMMON	Checkit_L2_CL05_v3x	35, 40, 41
Lidar Level 2 5km Aerosol Layer v3.x	read_hdf_l2_al05_v3x	L2_AL05_v3x_COMMON	Checkit_L2_AL05_v3x	35, 42, 43
Lidar Level 2 Aerosol Profile v3.x	read_hdf_l2_aerprf_v3x	L2_AERPRF_v3x_COMMON	Checkit_L2_AERPRF_v3x	64, 65
Lidar Level 2 Cloud Profile v3.x	read_hdf_l2_cldprf_v3x	L2_CLDPRF_v3x_COMMON	Checkit_L2_CLDPRF_v3x	70, 71
Lidar Level 2 Vertical	read_hdf_l2_vfm_v3x	L2_VFM_v3x_COMMON	Checkit_L2_VFM_v3	76, 77

Feature Mask v3.x			x	
Lidar Level 2 Polar Stratospheric Clouds v1.x	read_hdf_l2_psc_v1x	L2_PSC_v1x_COMMON	Checkit_L2_PSC_v1x	85, 86
Lidar Level 3 Aerosol Profile All Sky v3.x	read_hdf_l3_aerprf_v310	L3_AERPRF_v310_COMMON	Checkit_L3_AERPRF_v310	99 - 112
Lidar Level 3 Aerosol Profile Cloud Free v3.x	read_hdf_l3_aerprf_v310	L3_AERPRF_v310_COMMON	Checkit_L3_AERPRF_v310	99 - 112
Lidar Level 3 Aerosol Profile Cloudy Sky Transparent v3.x	read_hdf_l3_aerprf_v310	L3_AERPRF_v310_COMMON	Checkit_L3_AERPRF_v310	99 - 112
Lidar Level 3 Aerosol Profile Cloudy Sky Opaque v3.x	read_hdf_l3_aerprf_v310	L3_AERPRF_v310_COMMON	Checkit_L3_AERPRF_v310	99 - 112
IIR Level 1 v1.x	read_hdf_iir_l1_v112	IIR_L1_v112_COMMON	Checkit_IIR_v112	17, 18, 19
IIR Level 2 Track v3.x	read_hdf_iir_track_l2_v330	IIR_L2_TRACK_v330_COMMON	Checkit_IIR_TRACK_v330	93, 94
IIR Level 2 Swath v3.x	read_hdf_iir_swath_l2_v330	IIR_L2_SWATH_v330_COMMON	Checkit_IIR_SWATH_v330	96, 97
WFC Level 1B 1 km Registered Science v3.x	read_hdf_wfc_1rs	WFC_1RS_COMMON	Checkit_W1RS	27, 28
WFC Level 1B 1 km Native Science v3.x	read_hdf_wfc_1ns	WFC_1NS_COMMON	Checkit_W1NS	27, 29
WFC Level 1B 125 m Native Science v3.x	read_hdf_wfc_125	WFC_125_COMMON	Checkit_W125	27, 30

These readers can be called from within a program, or embedded into the user's program. Remember to include the associated common into the application software in order to have full access to the data. The user is also reminded to make certain that the IDL path parameters are set correctly under the IDL Preferences options.

To run these programs from the **Windows** IDL Development Environment (IDLDE) simply enter the command:

<Reader Name>, <Data Directory Full Path (single quotes)>, <Data File Name (single quotes)>

Examples in Windows Environment:

read_hdf_l1, 'C:\DATA\', 'L1_2007-00-00T00-00-00ZN.hdf'
read_hdf_l1_v420, 'C:\DATA\', 'L1-2007-00-00T00-00-00ZN.hdf'
read_hdf_l2_ml33_v420, 'C:\DATA\', 'L2_2007-00-00T00-00-00ZN_333mCloudLayer.hdf'
read_hdf_l2_cl01_v420, 'C:\DATA\', 'L2_2007-00-00T00-00-00ZN_1kmCloudLayer.hdf'
read_hdf_l2_cl05_v420, 'C:\DATA\', 'L2_2007-00-00T00-00-00ZN_5kmCloudLayer.hdf'
read_hdf_l2_al05, _v420 'C:\DATA\', 'L2_2007-00-00T00-00-00ZN_5km_aer_layer.hdf'
read_hdf_l2_ml05, _v420 'C:\DATA\', 'L2_2007-00-00T00-00-00ZN_5km_merged_layer.hdf'
read_hdf_l2_aerprf_v420, 'C:\DATA\', 'L2_2007-00-00T00-00-00ZN_5kmAerosolProfile.hdf'
read_hdf_l2_cldprf_v420, 'C:\DATA\', 'L2_2007-00-00T00-00-00ZN_5km_CloudProfile.hdf'
read_hdf_l2_vfm_v420, 'C:\DATA\', 'L2_2007-00-00T00-00-00ZN_VFM.hdf'

To run these programs from the **Unix** IDL Development Environment (IDLDE) simply enter the command:

<Reader Name>, <Data Directory Full Path (single quotes)>, <Data File Name (single quotes)>

Examples in Unix Environment:

read_hdf_l1_v420, '/DATA', 'L1-2007-00-00T00-00-00ZN.hdf'
read_hdf_l2_ml33_v420, '/DATA', 'L2_2007-00-00T00-00-00ZN_333mCloudLayer.hdf'
read_hdf_l2_cl01_v420, '/DATA', 'L2_2007-00-00T00-00-00ZN_1kmCloudLayer.hdf'
read_hdf_l2_cl05_v420, '/DATA', 'L2_2007-00-00T00-00-00ZN_5kmCloudLayer.hdf'
read_hdf_l2_al05_v420, '/DATA', 'L2_2007-00-00T00-00-00ZN_5km_aer_layer.hdf'
read_hdf_l2_ml05_v420, '/DATA', 'L2_2007-00-00T00-00-00ZN_5km_merged_layer.hdf'
read_hdf_l2_aerprf_v420, '/DATA', 'L2_2007-00-00T00-00-00ZN_5kmAerosolProfile.hdf'
read_hdf_l2_cldprf_v420, '/DATA', 'L2_2007-00-00T00-00-00ZN_5km_CloudProfile.hdf'
read_hdf_l2_vfm_v420, '/DATA', 'L2_2007-00-00T00-00-00ZN_VFM.hdf'
read_hdf_l3_cloudoccrrence_v100, '/DATA', 'CAL_LID_L3_Cloud_Occurrence-Standard-V1-00.2009-02D.hdf'

HDF 5 Readers

A set of basic CALIPSO data product readers has been developed to aid users in their ability to read the HDF5 formatted files. These routines support the CAL_LID_L2_BlowingSnow_Antarctica-Standard-V1-00 data product. This data product's parameters' information can be found in the DPC Release 4.60 Section 2.15 Tables 88 through 91.

The Blowing Snow readers provide two options to the user; reading the complete Blowing Snow data product or reading a specific parameter from the data product.

read_Blowingsnow.pro will open the hdf5 file and read each of the datasets.

read_parameter_BlowingSnow.pro will open the hdf5 file and read a specific dataset specified by input argument.

read_BlowingSnow.pro
idl_prompt> .compile read_BlowingSnow

Input PARAMETERS:

year -	Year to process:	year = '2010'	(range: 2006-2018)
month -	Month to process:	month = '03'	(range 01-12)
region -	Region to process:	region = 'Antarctica'	('Arctic', 'Antarctica', 'Polynya', 'Greenland')
version -	Release version:	version = '1-00'	

Data File Names… Please do not change the name of the data file names. The code is written to expect the generated file names.

Example of setting input arguments on command line
Idl_prompt> year = '2010' & month = '03' & region = 'Antarctic' & version ='1-00'

CALLING SEQUENCE:
idl_prompt> read_Blowingsnow, year, month, region, version

NOTE TO THE USER: Currently the way this program is written, you will have to modify this code to display/work with specific parameters within each data file.

read_parameter_BlowingSnow.pro
idl_prompt> .compile read_parameter_BlowingSnow

(this will compile program “read_parameter_BlowingSnow.pro” and function “get_parameter.pro”)

Input PARAMETERS:

year	- Year to process:	year = '2010'	(range: 2006-2018)
month	- Month to process:	month = '03'	(range 01-12)
region	- Region to process:	region = 'Antarctica'	('Arctic', 'Antarctica', 'Polynya', 'Greenland')
version	- Release version:	version = '1-00'	
group	- HDF5 Group	group = ‘Geolocation_Fields’	('Ancillary_Fields', 'Geolocation_Fields', 'Metadata', 'Snow_Fields')
parameter	- Dataset Name	parameter = ‘Latitude’	(see user guide for data product contents)

Data File Names… Please do not change the name of the data file names. The code is written to expect the generated file names.

setting input arguments
idl_prompt> year = '2010' & month = '03' & region = 'Antarctic' & version ='1-00' & group = 'Geolocation_Fields' & parameter = 'Latitude'

CALLING SEQUENCE:
data = read_parameter_Blowingsnow, year, month, region, version, group, parameter

NOTE TO THE USER: The program does not have to be modified to display specific parameters. This is controlled at the command line.